



Unraveling the Origins of

A SYMBOL OF THE TROPICS

The coconut variety Niu Leka, or Fiji Dwarf (see back cover), from the South Pacific may represent the earliest lineage in the coconut's domestication.

The coconut tree is a symbol of the Tropics, and as a source of fiber, food, fuel, soap, and cooking oil, it is sometimes called “the tree of life.” But one aspect of the tree has remained a mystery—its origins. Scientists have debated the tree’s genealogical roots for decades.

Using genetic markers found in coconuts and other palm trees from around the world, Alan Meerow, a geneticist with the USDA-ARS Subtropical Horticulture Research Station in Miami, Florida, has completed a phylogenetic analysis of a large group

of palm species (the Attaleinae subtribe) that provides the most comprehensive look yet at the coconut tree’s family history. The results suggest that the ancestors of the coconut tree originated in South America, that the tree’s closest living relatives are a modern genus of American palms (the genus *Syagrus*), and that it diverged from them about 35 million years ago. The genus *Syagrus* includes another popular Florida ornamental, the queen palm.

Meerow and colleagues also found that the modern coconut tree probably evolved about 11 million years ago, perhaps in the South Pacific. The Fiji Dwarf, a variety of coconut tree now grown in the United States, shares its South Pacific ancestry with many of today’s other coconut varieties, according to Meerow. “The Fiji Dwarf is more distantly related to all these other varieties,” he says.

The work, published in *PLoS One*, is more than an academic exercise. Five of the 80 known varieties of coconut tree are major ornamentals in Florida. Identifying their closest relatives will help in the search for genes with traits capable of resisting diseases, insect pests, and other threats. An epidemic of lethal yellowing phytoplasma in the early 1980s destroyed an estimated 100,000 coconut palms in South Florida. Bud rot, caused by several fungal pathogens, threatens coconut production around the world.

“The more we know about it, the easier it will be to address future threats,” Meerow says.

Patterns of differences in DNA can open a window into a plant’s evolutionary past, revealing when it diverged from its ancestors. Meerow and colleagues looked for patterns among a family of genes developed as markers by ARS researchers studying cacao (chocolate) plants. Known as “WRKY genes,” they are valuable “clocks” for dating the occurrence of important evolutionary events.

With these molecular clocks and evidence from fossil palms, Meerow traced the coconut tree’s ancestry back more than 40 million years to palms that grew in both Madagascar and eastern Brazil. He also found that milestones in the coconut’s early “family tree” coincide with major geological events in South America, making it likely they played a role in how these palms evolved. A group of palm species in southern Brazil, for example, split off from a relative in Chile about 14 million years ago, around the time when geological events gave rise to the Andes Mountains. The extensions of oceans into the western Amazon region that lasted from 25 to 30 million years turned dry areas into wetlands and probably altered the evolution of coconut ancestors growing at the time across South America, Meerow says.—By **Dennis O’Brien, ARS.**

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